The Mexican *Chaptalia hintonii* is a *Gerbera* (Asteraceae, Mutisieae)

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ABSTRACT. *Chaptalia hintonii* Bullock, endemic to Mexico, has floral characters that indicate affinities to the genus *Gerbera*. A new nomenclatural combination, *Gerbera hintonii* (Bullock) Katinas, is proposed, and a redescription and illustration of the species is presented. The differences between *Chaptalia* and *Gerbera*, and the relationships between *G. hintonii* and the allied sections of *Gerbera*, are discussed.

A systematic revision in progress of the genus *Chaptalia* has shown that the Mexican *Chaptalia hintonii* (Bullock, 1936) exhibits morphological characters that separate this taxon from *Chaptalia* and approach those of *Gerbera*.

Gerbera (Asteraceae, Mutisieae), with 28 species, belongs to the Mutisiinae, a predominantly American subtribe, although a quarter of its species occur outside of the Americas (Cabrera, 1977). Within the subtribe, *Gerbera*, together with *Chaptalia*, *Leibnitzia*, *Lulia*, *Perdicium*, *Trichocline*, and *Uechtritzia*, forms a natural group, called either the *Gerbera*-complex or the scapose-complex (Jeffrey, 1967a; Hansen, 1990). However, the generic boundaries between *Gerbera* and some of the other genera of this complex have been problematic. The main morphological characters used to separate them are the types and number of series of the ray florets, the presence or absence of staminodes (Burkart, 1944), the texture of the pappus (Jeffrey, 1967a), the apex of the cypselas being either truncate or rostrate (Zardini, 1975), and the types of cypsela hairs (Jeffrey, 1967a; Nesom, 1983; Hansen, 1990).

Thus, the generic lines between *Gerbera* and *Chaptalia* are vaguely drawn. Jeffrey (1967a) accepted an Old World genus *Gerbera* and a New World genus *Chaptalia*. Hansen (1985a, b, 1988) revised the sections of *Gerbera*, although he did not establish a clear-cut differentiation between *Gerbera* and *Chaptalia*. The first, partial, systematic treatment of *Chaptalia* is that of Burkart (1944) who, focusing on the Argentine species, recognized seven sections in the genus. He analyzed some characters to distinguish *Chaptalia* and *Gerbera*, i.e., ray florets bilabiate, in one series, with staminodes; cypselas without a rostrum; and leaves densely pubescent above. Burkart recognized exceptions in most of these characters, and postulated that some species of *Chaptalia* could be a point of union with other, related genera, e.g., his section *Archichaptalia* with *Trichocline*. Years later, some species from section *Archichaptalia* and from other sections were transferred to *Leibnitzia* (Nesom, 1983). Recently, Nesom (1995), in a revision of the North American and continental Central American species of *Chaptalia*, corroborated that the generic boundaries between *Chaptalia* and the Old World *Gerbera* are problematic. In his study, Nesom found specimens that produce small, abortive stamens, a character that deviates from the traditional definition of *Chaptalia*.

The new species *Chaptalia hintonii*, from Mexico, was described by Bullock (1936) and distinguished from *C. nutans* (L.) H. Polakowsky by its long-petiolate leaves. Subsequently, *C. hintonii* was included in taxonomic (Nesom, 1995) and floristic treatments (e.g., Matuda, 1958; Martínez & Matuda, 1979) of *Chaptalia*. In the most recent treatment of *Chaptalia*, *C. hintonii* was placed in section *Chaptalia* together with five other species on the basis of its ebracteate scapes, heads nodding in bud, disk florets with sterile ovaries, and relatively broad ligules with a purple, abaxial, midstrip (Nesom, 1995). From the members of this section, the morphologically closest to *C. hintonii* is *C. lyratifolia* A. Burkart by virtue of the pinnatifid shape of the leaves and the developed inner lip of the ray florets (bilabiate). *Chaptalia hintonii*, however, differs from this and from the other species of the section by the presence of staminodes in the ray florets. The characteristic lack of staminodes in *Chaptalia* and their presence in *Gerbera* led me to place *C. hintonii* in the genus *Gerbera*.

Gerbera differs from *Chaptalia* by having all its florets bilabiate (outer lip tridentate, inner lip bipartite), its ray florets generally with a showy outer lip conspicuously surpassing the involucre, and the

staminodes in the ray florets present (lacking in *G. parva* N. E. Brown, occasionally in *G. piloselloides* (L.) A. H. G. de Cassini). A series of inner ray florets, present in some species of *Gerbera*, are morphologically similar to the outer ones, but reduced in size. Occasionally, one may find in a capitulum some ray florets with the inner lip reduced, giving the corolla a ligulate appearance. Some species of *Gerbera* exhibit short, U- or cup-shaped style branches (Hansen, 1990).

The outer ray florets of *Chaptalia* are ligulate or with a scarcely developed inner lip, and are generally shorter than the involucre or surpass it by only a few millimeters. The corolla of the inner ray florets is filiform and reduced (bilabiate, tubulose, or ligulate), irregularly lobed at the apex, and generally much shorter than the style. Both the outer and inner ray florets completely lack staminodes. The disk florets of *Chaptalia* are bilabiate or tubulose, and the style in *Chaptalia* is either scarcely cleft at the apex, or is deeply divided into linear branches; the U-shaped morphology of the style branches of *Gerbera* is not present.

Occasionally, *Chaptalia* species exhibit floral characters that approach those of *Gerbera*, showing the close relationship between the genera. For instance, in some species of *Chaptalia* the corollas of the ray florets have relatively broad ligules (*C. exscapa* (C. H. Persoon) J. G. Baker var. *chilensis* (DC.) A. Burkart, *Chaptalia* sect. *Chaptalia*), or bilabiate ray florets (*C. lyratifolia*). However, the lack of staminodes in all these species is a character that distinguishes them from *Gerbera*.

The development of staminodes, together with the type of cypsela hairs, appears to be a key character in the evolution of the *Gerbera*-complex. The phylogenetic analysis of the *Gerbera*-complex performed by Hansen (1990) shows that there is a reduction series from the plesiomorphic condition "sterile anthers" containing a few pollen grains (*Lulia, Trichocline, Uechtritzia*, somewhat more reduced in *Gerbera* sect. *Isanthus*) to total loss of anthers. The apomorphic condition is represented by a reduction to thread-like or vestigial staminodes (*Gerbera* sects. *Lasiopus* (A. H. G. de Cassini) Schultz-Bipontinus, *Pseudoseris* (H. E. Baillon) C. Jeffrey, and *Piloselloides* C. F. Lessing, and *Leibnitzia*) or to their complete absence (*Chaptalia, Gerbera* sect. *Parva* H. V. Hansen, *Perdicium*).

The twin hairs on the cypselas are also of diagnostic importance in the *Gerbera*-complex (Jeffrey, 1967a; Hansen, 1990) and differentiate *Chaptalia* and *Gerbera* to some degree. Restricted to Asteraceae, twin hairs ("Zwillingshaare" of Hess, 1938) are composed of two reduced basal cells and two cylindrical hair cells. According to the classification of the cypsela hairs in the Nassauviinae (Freire & Katinas, 1995), the closest subtribe to the Mutisiinae (Cabrera, 1977; Jansen & Palmer, 1988; Bremer, 1994), *Gerbera* has twin hairs of subtypes *basic* (70–140 μm long), *rounded* (30–40 μm long), and *filiform* (220–350 μm long), while *Chaptalia*, which also has subtypes *basic* and *rounded*, plus *asymmetric* (with one hair cell shorter, 100–110 μm long), completely lacks subtype *filiform*. The short trichomes (*basic, rounded, asymmetric*) give the cypselas a papillose appearance, whereas the cypselas with long (*filiform*) trichomes are villous.

Finally, most chromosome counts have shown *Gerbera* to have $n = 25$ ($2n = 50$), and *Chaptalia*

Table 1. Comparison of significant morphological characters and distribution of *Gerbera hintonii* with those of *Gerbera* sects. *Lasiopus*, *Piloselloides*, and *Pseudoseris*.

	Gerbera hintonii	*G.* sect. *Lasiopus*	*G.* sect. *Piloselloides*	*G.* sect. *Pseudoseris*
Scapes	not widened below the capitula	not widened below the capitula	widened below the capitula	not widened below the capitula
Series of ray florets (outer-inner ray florets)	2	2	2	1 (only outer) or 2
Length of outer ray florets	3–7 mm more than the involucre	up to 20 mm more than the involucre	2–3 mm more than the involucre	up to 8mm more than the involucre
Staminodes	present	present	present (rarely absent)	present
Cypselas	shortly rostrate	shortly rostrate	longly rostrate	shortly rostrate
Types of cypsela twin hairs	*basic; rounded*	*filiform*	*basic*	*filiform* or cypselas glabrous
Distribution	Mexico	Africa	Africa and Asia	Africa (Madagascar)

$n = 24$ ($2n = 48$) (e.g., Moore, 1973). There have been found, however, reports of $n = 25$ and $2n = 50$ in *Chaptalia nutans* (Teppner & Tropper, 1984; for this species there are also many reports of $n = 24$, $2n = 48$), and $n = 24$ in two species of *Gerbera* (Gupta et al., 1989; Platonova et al., 1985). Additional data may provide valuable information on this character in the future.

Chaptalia hintonii is much closer to *Gerbera* in its floral characteristics. Thus, all its florets are biabiate, the outer ray florets conspicuously surpass the involucre, and the ray florets possess staminodes (Fig. 1C), all characters described and illustrated by Bullock (1936) himself in the original description of *C. hintonii.* These staminodes would correspond to the thread-like ones pointed out by Hansen (1990). Occasionally there are mixed in the same capitulum inner ray florets with staminodes and inner ray florets without staminodes. With the typical U-shaped morphology of the style branches, as in some species of *Gerbera,* all these floral characters have now led to the transfer of this species to *Gerbera.*

Gerbera hintonii can be related to *Gerbera* sect. *Lasiopus,* sect. *Piloselloides* or sect. *Pseudoseris* because of its ebracteate scapes, and the biseriate ray florets, i.e., with both outer and inner ray florets. When one compares *G. hintonii* to species of these three sections (Table 1), the species of section *Piloselloides* seem to be the most closely related by virtue of the length of the outer ray florets and the type of pubescence on the cypselas. On the other hand, *G. hintonii* does not have the scape widened below the capitulum, as in section *Piloselloides,* and its cypselas are shortly rostrate. It is interesting to note that Burkart (1944) pointed to the relationship of *Chaptalia* to *Gerbera piloselloides* (sect. *Piloselloides*) as a case of evolutionary convergence. Jeffrey (1967b), when raising section *Piloselloides* to the rank of genus, also emphasized a close morphological alliance between this taxon and the New World genus *Chaptalia.* Thus, the relationship of *G. hintonii* with *Gerbera* sect. *Piloselloides* suggested here is consistent with these hypotheses.

From a distributional point of view (Fig. 2), the presence of a species of *Gerbera* in Mexico represents the second record of the genus in the Americas. *Gerbera* was long considered exclusively African and Asiatic (cf. Hansen, 1985a, b, 1988), until Zardini (1974) transferred the Peruvian and Ecuadorian *Trichocline hieracioides* (Kunth) Ferreyra to *Gerbera* (*G. hieracioides*). This species was considered as a probable monotypic genus of the Mutisiinae by Hansen (1990), with a morphology intermediate between *Gerbera* and *Trichocline:* style arms with a tufted mat of hairs (as in *Gerbera gossypina* (Royle) G. Beauverd of sect. *Isanthus*), cypselas with a terminal callus (as in *Trichocline*), and multicellular, rigid, conical hairs on the ray tube (as in *Trichocline*). The presence of "subinflate" cypsela hairs (i.e., length mean = 143 μm and width mean = 26 μm) was considered by Hansen as unique within the *Gerbera*-complex. The length of the "subinflate" hairs would correspond to the length of the *basic* cypsela hairs (140 μm) described above. The presence of staminodes (more reduced than in *Trichocline*) and the rostrate cypselas, which characterize this South American species, suggest its inclusion in *Gerbera* and thus represents the first record of this genus in the Americas. In spite of the *filiform* cypsela hairs that characterize *Gerbera* sect. *Isanthus, G. hieracioides* can be related to it by its recurved leaf margins bent backward, bracteate scapes, and uniseriate rays with well developed staminodes. Hansen (1985b) proposed that it is likely that *Gerbera* has followed two lines of evolution, one having bracteate scapes and only one series of rays (e.g., sect. *Isanthus*), and another with bracteate scapes and developing two series of rays (e.g., sect. *Piloselloides*). Thus, the Peruvian-Ecuadorian and the Mexican species of *Gerbera* do not appear to be closely related.

The presence in Ecuador, Peru, and Mexico of a mainly African and Asiatic genus such as *Gerbera* raises interesting questions about the biogeography of *Gerbera* and the whole *Gerbera*-complex. It has been suggested that vicariant processes rather than dispersal events could have played a major role in the distribution of this complex of genera (Hansen, 1990). On the other hand, other authors consider that there are many such Afro-American disjunct taxa that suggest long-distance dispersal, perhaps more commonly in Mid or Late Tertiary times when the distances between the continents were not quite as great as they are today (Iltis, 1967).

The following new combination, with a redescription of *G. hintonii,* is made here:

Gerbera hintonii (Bullock) Katinas, comb. nov. Basionym: *Chaptalia hintoni* Bullock, in Hooker's Icon. Pl., ser. 5, 4: 1, tab. 3346. 1936. TYPE: Mexico. México: District Temascaltepec, Nanchititla, cliffs, 1 May 1933, *G. B. Hinton 3098* (holotype, K not seen, photograph LP; isotypes, MO, US). Figure 1.

Perennial, scapose herb, 12.5–33 cm high; rhizomes 1–4.5 cm long. Leaves in a basal rosette, pinnatisect, commonly with only the upper lobe de-

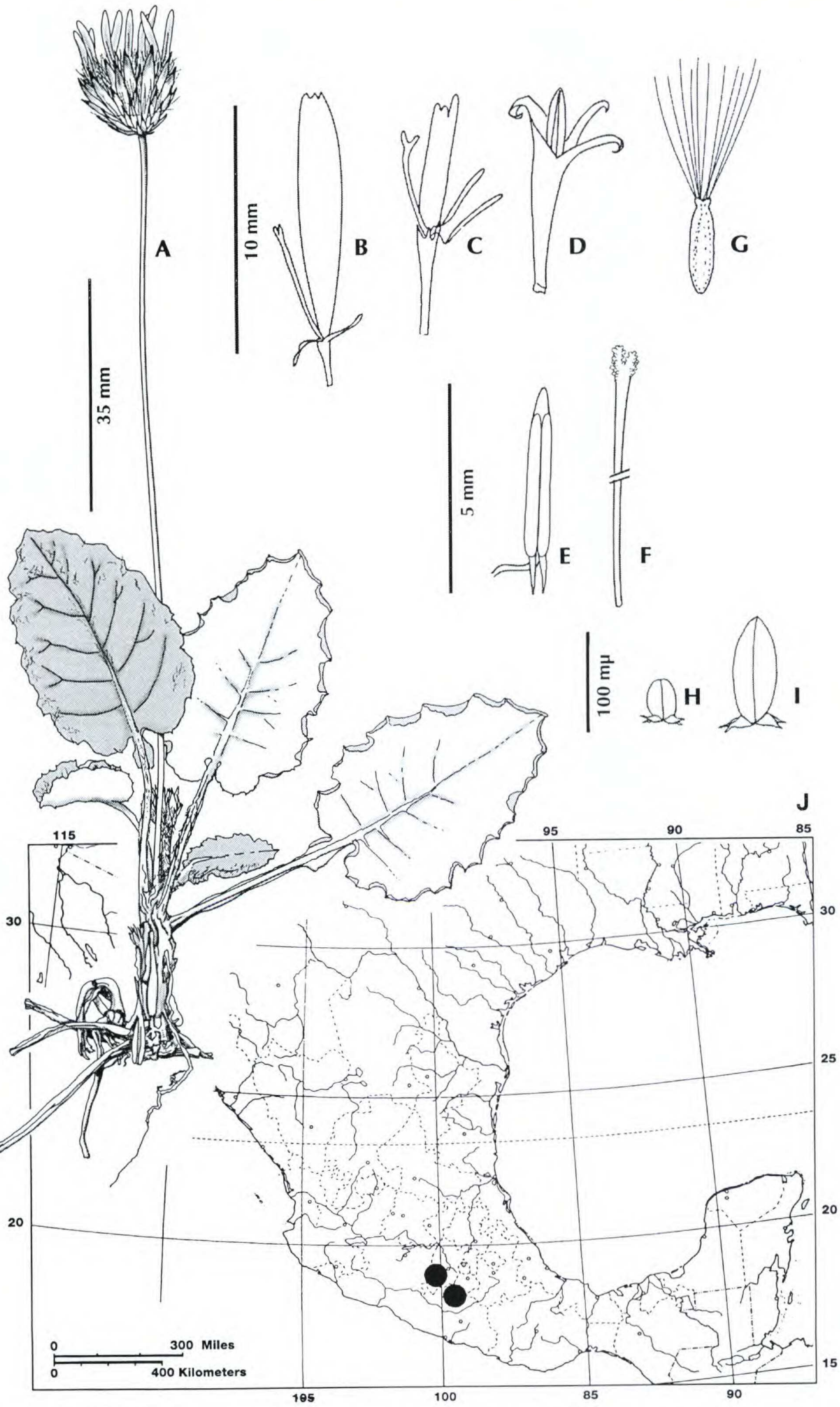

Figure 1. *Gerbera hintonii* (Bullock) Katinas. —A. Habit. —B. Outer ray floret. —C. Inner ray floret with staminodes. D–F. Disk floret. —D. Corolla. —E. Stamen. —F. Style. —G. Cypsela. H, I. Cypsela hairs. —H. *Rounded* twin hair. —I. *Basic* twin hair. —J. Distribution in Mexico. A–G. *Hinton 3465* (US). H, I. *Rzedowski 25225* (WIS).

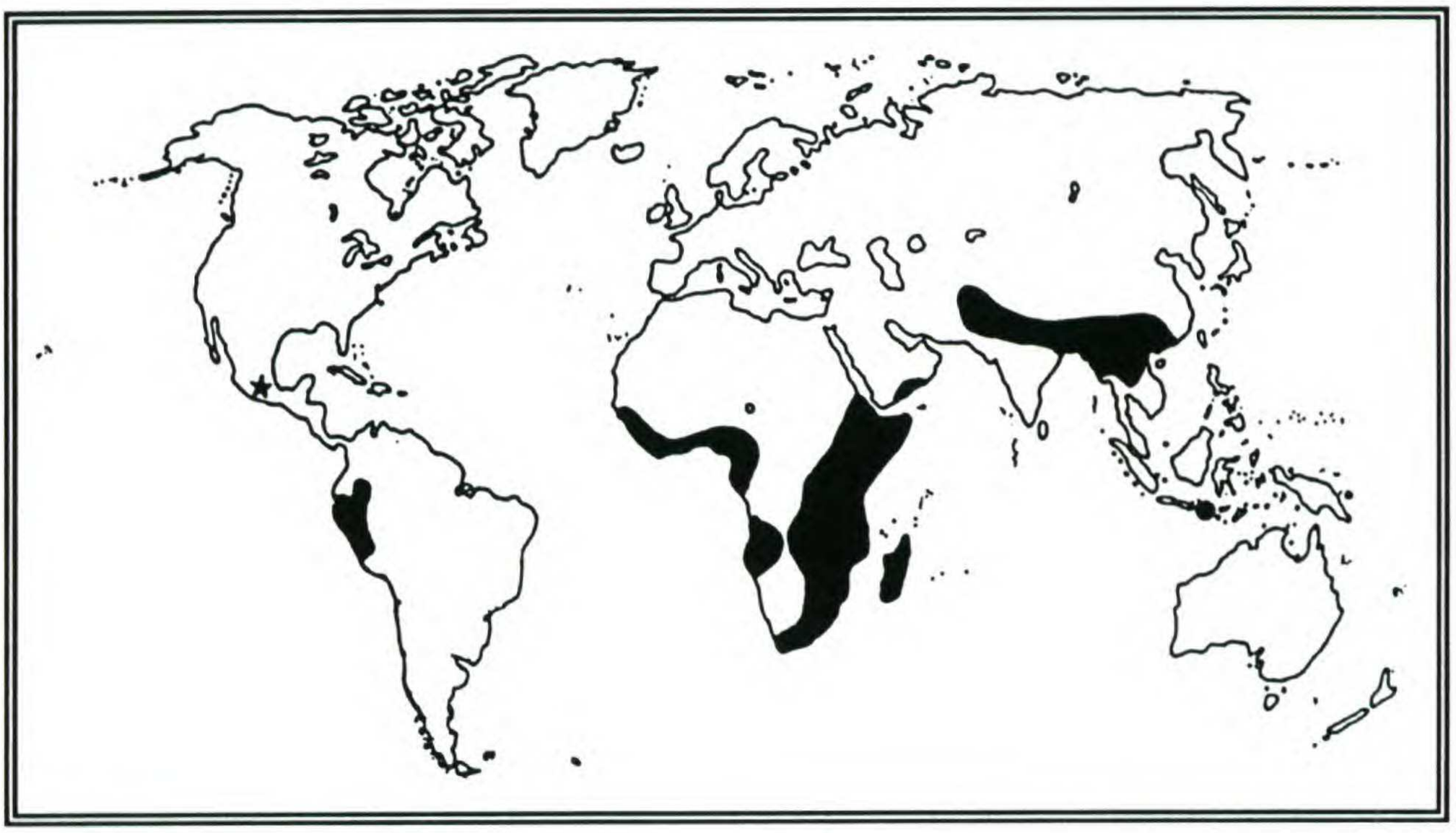

Figure 2. General distribution of the genus *Gerbera*. Star = *G. hintonii*.

veloped and the rest of the blade reduced to a wing along the pseudopetiole, or to 1–2 minute lateral lobes; upper lobe 3.5–11 cm long, 1–9.5 cm wide, elliptic to ovate, planate, acute to obtuse at the apex, cordate at the base, crenate-mucronulate, glabrous or araneose-pubescent above, yellowish green tomentose beneath; pseudopetiole 1.5–12 cm long. Scapes 11–32 cm long, monocephalous, ebracteate, not widened below the capitula, tomentose. Capitula 18–20 mm long, 12–20 mm wide, turbinate, radiate, heterogamous. Receptacle alveolate, naked, glabrous. Involucre bracts 4–5-seriate, imbricate, increasing in size inward, purple at the margins, apex and midrib, glabrous or pubescent: first series 3–5 mm long, 0.3–0.5 mm wide, linear; second series 4–8 mm long, 0.4–1 mm wide, linear; third series 7–11 mm long, 0.8–1.2 mm wide, linear-oblong; fourth and fifth series 9–14 mm long, 1 mm wide, oblong, scarious at the margins. Florets 50–60, trimorphic, bilabiate, with outer lip tridentate, inner lip bipartite and occasionally reduced, white (yellowish when dry), glabrous; outer ray florets pistillate, longer than the involucre, with tube 3–5 mm long, with outer lip 9–13 mm long, inner lip 3–5 mm long, style 6.5–9 mm long, branches 0.3–0.7 mm long, the florets occasionally with staminodes; inner ray florets few, functionally pistillate, tube 1–3 mm long, outer lip 5–7 mm long, inner lip 0.8–2.5 mm long, style 6–7.5 mm long, branches 0.2–0.8 mm long, staminodes 1–3, vestigial, 1–3 mm long; disk florets functionally staminate (ovaries sterile, empty), with tube 1.5–3 mm long, outer lip 3–3.5 mm long, inner lip 3 mm long, style 7–8.5 mm long, branches 0.3–0.4 mm long; stamens caudate, with entire, oblong apical appendage, with anthers 3.5–7 mm long, tails 0.3–1.5 mm long. Cypselas 2.5–4 mm long, ellipsoid, cylindric, attenuate at the apex or with a constricted neck, 5-ribbed, papillose pubescent (*basic* and *rounded* twin hairs). Pappus white, caducous, the bristles scabrous, 4–8 mm long.

Distribution and ecology. On rocky cliffs, in woods or grassy places, endemic to the states of Guerrero and México, in southern Mexico, at 1800–2160 m. Flowering from March to November.

In an observation on the morphological characters, included in the protologue to *Chaptalia hintonii*, Bullock (1936) named as "type" the specimen *Hinton 3465*. It was probably a lapse in Bullock's writing because the type specimen (holotype) was previously pointed out by him in the exsiccata as: "*Hinton 3098* (type)."

Use of the epithet *hintonii* instead of *hintoni* as originally published by Bullock merits brief comment. As the Latin gender of the name "Hinton" is masculine and singular, the ending of the genitive case is "ii" according to Article 60, Recommendation 60c of the *International Code of Botanical Nomenclature* (Greuter et al., 1994).

Paratypes. MEXICO. District Temascaltepec, Nanchititla, 28 Aug. 1935, *Hinton 8228* (MO), 15 Oct. 1935, *Hinton et al. 8562* (MO, US); La Sierrita, 4 Mar. 1933, *Hinton 3465* (MO, US).

Other specimens examined. MEXICO. **Guerrero:** 3 km al SE de Tetipac, sobre la carretera a Taxco, 21 Nov.

1967, *Rzedowski 25225* (US, WIS); 3.5 km SSE of Tetipac, on road from Taxco, 14 Aug. 1981, *Nesom 4409* (US).

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